(which has no effect upon the ratio) and precipitation reduces the level of Cu and Zn in Camp Lake to the present 9 ppb and 72 ppb respectively. Consequently, 221 ppb of Cu and 278 ppb of Zn have been lost, which results in a calculated Zn/Cu ratio of 1.26 for Camp Lake sediments which is remarkably similar to the measured value of 1.34.

B. Stream Waters and Sediments

The lack of a significant number of streams in the study area precludes extensive detailed examination of stream waters and sediments. Except for a segment of the main drainage system at Camp Lake, data on streams are minimal. Because sampling of B-C stream water was very close to the edge of Camp Lake, the progressive rise of metal values (Table 15) may reflect diminishing discharge from Banana Lake resulting in samples which contain increasingly greater portions of Camp Lake waters. Alternatively, groundwaters from the area adjacent to the southernmost portion of Banana Lake contain high to very high metal values and may be increasingly important as soils gradually thaw and groundwater flow increases. The Zn peak recorded for the Camp Lake exit stream in early June (Table 15) is the result of a large contribution of anomalous snow-melt runoff ($\overline{X}$ = 100 to 200 ppb Zn for the Camp Lake basin).

Detailed measurements of B-C stream water pH reveal near neutral pH's close to Banana and Camp Lakes but slightly acidic to acidic pH's (5.5 to 6.5) near the central portion of B-C stream. Water closest to the stream banks is more acidic than that in mid stream, presumable because of the addition of low pH ground/snow-melt waters.

The high level of Cu relative to Zn in B-C stream sediment (Table 28) is a reflection of the mobility difference between Cu and Zn. Consequently, mixing of acidic, metal-rich ground/snow-melt waters with near neutral waters in B-C stream results in rapid loss of Cu and Fe (site 161) and a delayed loss of Mn and Zn (site 159) resulting in high levels of the latter two elements being displaced down stream relative to Cu and Fe.

C. Lake Waters

Lake water anomalies can be classified according to the manner in which a lake receives metal as either: 1) direct input (i.e. mineralization is at least in part exposed or concealed beneath lake waters) or 2) indirect input via the lake drainage basin from: A) metal-rich groundwater draining mineralization; B) metal-rich groundwater draining, metal-rich till, and/or C) inflow from anomalous streams and/or other lakes. As might be expected, indirect metal input into a lake is significantly more common than direct metal input because of the larger area from which indirect input can originate (i.e. the drainage basin) and widespread glacial dispersion of mineralization. Consequently, anomalous Zn and Cu concentrations are restricted to those lakes that contain mineralization or lie down ice and/or down drainage from mineralization (Fig 101).

In addition to considering the manner by which metal may enter a lake, it is also worthwhile examining anomaly size, degree of geochemical contrast and development with respect to drainage and glacial dispersion of mineralization. Geochemical data for the lakes adjacent to the Main Zone provide good examples of the various metal input types and show the importance of drainage and glacial dispersion of mineralization in relation to anomaly formation.

Geochemical anomalies within Camp Lake, beneath which much of the Main or "A" Zone mineralization lies, can be considered as Type 1; however, Camp Lake also receives very significant amounts of groundwater draining both mineralization (Type 2A) and highly anomalous till (Type 2B). The latter two types are probably more responsible for the formation of the lake water anomaly than is the sub-aqueous position of sulphides.

Because Camp Lake is normally ice covered until late June and the peak snow-melt runoff occurs in early to mid June, metal rich snow-melt water flows onto the ice covered lake and then to the exit stream, which is open early in the season, without making contact with Camp Lake Waters. As a result, water movement (i.e. metal input) into Camp Lake from the drainage basin as a whole is minimal until the protective ice cover begins to break up. Although break up of Camp

Lake ice is only one to two weeks after the peak snow-melt runoff, the time necessary to go from little to maximum snow melt to the melting of the last few snowbanks is very short (1 to 3 weeks). Therefore, except for small, shallow lakes which lose their ice cover early in the season, the homogeneity of lake waters is preserved from the initial snow-melt "flushing effect" (Fig. 7) as postulated by Jonasson and Allan (1973). As a result, indirect metal input into Camp Lake is largely limited to metal-rich groundwater from the thawing active layer and, to a lesser extent, the last remnant snowbanks.

Although Banana Lake lies adjacent to the Main or "A" Zone mineralization, Cu and Zn values are low because this lake lies up drainage and is not in the glacial dispersion path of mineralization. Consequently, Banana Lake receives little or no metal-rich ground, stream or other lake waters which could create an anomaly. Conversely, Bat and Cathy Lakes are removed from both mineralization (Fig. 17) and drainage from mineralization (Fig. 12). Nevertheless, Cu and - in particular - Zn values within these lake waters are anomalous because these two lakes lie down ice from the Main or "A" Zone massive sulphides. As a result, Cu and Zn soil anomalies can be found within their drainage basins to provide a source of metal-rich groundwater (i.e. Type 2B input). Because the situation is largely analogous to Camp Lake, it is not surprising that Zn/Cu ratios for these two lakes are nearly identical to Camp Lake, even though Cu and Zn values are three to four times lower than in Camp Lake (Table 31). Some drainage from soils may also be giving rise to the slightly high Zn values in the upper reaches of Banana Lake and the two smaller lakes further up drainage.

Lower Sunken Lake is physically separated by an esker from Upper Sunken Lake and the stream connecting Camp and Upper Sunken Lakes (Plate 16). Soils southwest of Lower Sunken Lake are comprised of medium to coarse glaciofluvial deposits characterized by low Cu and Zn values. Consequently, drainage from the southwest could not be giving rise to the highly anomalous Zn values in Lower Sunken Lake. Instead, it is suggested that seepage from Upper Sunken Lake and the stream (both highly anomalous in Zn and Cu) along the northeast flank of the esker is entering Lower Sunken Lake through the permeable esker material (i.e. Type 2C input).

A similar situation exists at the Anne-Cleaver Lakes Area. Flying Horse and Cleaver Lakes lie immediately down ice of the East Cleaver Lake mineralization and contain highly anomalous Cu and Zn concentrations. It is suggested that the very high Cu and Zn values within these two lakes are hydromorphically derived from the surrounding highly anomalous till and, to some extent, bedrock mineralization via groundwater and, to a lesser extent, snow-melt runoff (Figs. 17, 101, B6, B26, B38, B39 and Table 31). Further down ice, and down drainage, Cu and Zn values in lake waters decrease towards background levels.

Table 31. Comparison of Cu and Zn dispersion in lake waters near the Main and East Cleaver Lake Zones and at the Agricola Lake prospect.

Lake	ppb Zn	 Cu	Zn/Cu	pH	D^2	Drainage Position[3]	Possible Metal Sources[4]
			Camp Lake Area				
First Banana	1	1	1	7.3	1.5	up	2AB
Banana	1	1	1	7.0	0.7	up	2AB
Camp	71	9	8	7.0	0.0	down	1,2ABC
Upper Sunken	63	8	8	7.0	1.0	down	1,2ABC
Lower Sunken	30	2	15	7.0	1.3	down	2ABC
Cathy	28	3	9	7.2	1.3	up	2ABC
Bat	16	2	8	7.3	1.0	up	2ABC
			Anne-Cleaver Lakes Area				
Cleaver	166	5	33	7.0	0.3	down	1,2AB
Flying Horse	404	27	15	7.3	0.9	down	2ABC
Anne	45	6	7	7.4	1.0	down	1,2ABC
Turtle	17	3	6	7.6	2.2	down	2BC
N. Turtle	13	2	6	7.6	3.2	down	2BC
Wedge	7	1	7	7.7	3.4	down	2BC
Selma	4	2	2	7.6	6.0	down	2BC
			Agricola Lake Area[1]				
W 472	186	59	3.2	3.8	0.4	down	2ABC
W 471	176	56	3.2	3.9	0.8	down	2BC
W 485	28	5	3.1	4.8	1.2	down	2C
W 487	28	5	5.6	5.2	2.0	down	2C
W 490	11	2	5.5	5.7	2.3	down	2C
W 483	8	5	1.6	4.7	0.2	up	2B
W 482	13	4	3.2	6.0	0.3	up	2C
W 481	13	3	4.3	6.0	0.7	up	2C
W 475	18	9	2	3.7	0.7	down	2BC
W 480	8	2	4	6.1	1.8	down	2C
W 496	7	2	3.5	6.0	2.3	down	2C
W 494	8	2	4.0	6.0	2.4	down	2C

1: See Cameron and Lynch (1975) for details.

2: D = distance to massive sulphide (miles).

3: Relative position of the lake in the drainage system with respect to massive sulphides (i.e. either up or down drainage from mineralization).

4: For explanation of symbols see text. Where more than one possible source, major source(s) are underlined.

In lake waters, Cu concentrations and contrast are lower and dispersion more restricted relative to Zn (Fig. 101 and Table 31). This may reflect the Cu-poor nature of mineralization or alternatively, the slightly lower mobility of Cu relative to Zn. The latter possibility is preferred based on Cu and Zn sulphate solubilities (Table 29), soil geochemical patterns, contrast ratios (Table 10) and Cu and Zn concentrations and patterns in seepage/pit and snow-melt runoff (Chapter 4, Section IV).

The mobility difference between Cu and Zn in lake waters is particularly evident on examination of Zn/Cu ratios, concentrations and the distance down drainage from mineralization (Table 31). For example, in lakes containing background levels of Cu and Zn (e.g. Banana Lake), Zn/Cu ratios are low (<4); whereas, in lakes containing anomalous concentrations of Cu and Zn near or down drainage from the Main Zone (e.g. Upper Sunken or Camp Lake), Zn/Cu ratios are significantly higher ($\geq$8.0). In Lower Sunken Lake, which is in the same drainage as Upper Sunken Lake but is separated from it by an esker (Plate 16), the Zn/Cu ratio is approximately 15.0. Consequently, although Cu presents a smaller target, it is also more likely to pinpoint mineralization than is Zn.

Examination of Cu and Zn dispersion down drainage from the Cleaver Lake mineralized zone (Fig. 17) and at the Agricola Lake prospect, also shows that Zn is more widely dispersed than Cu, but with different Zn/Cu ratio distributions (Table 31).

Relative to Camp Lake, Cu and, in particular, Zn levels in the Anne-Cleaver drainage system are higher and display higher Zn/Cu ratios in proximity to mineralization. Down drainage from mineralization there is a constant decrease in ratio values as Zn is more gradually reduced to background levels relative to Cu. Although Flying Horse Lake has the highest total Cu and Zn values, Cleaver Lake has the highest Zn/Cu ratio and lies closest to the orebody. Conversely, at Agricola Lake, pH's are much lower (3.8 to 6.0) and Zn/Cu ratios in proximity to mineralization are correspondingly low (2.0 to 3.0) and increase only slightly down drainage. However, Cu is more abundant in the soils and in the ore at Agricola Lake relative to Bathurst Norsemines and this may play a role in lowering the Zn/Cu ratios. In general, the lower the pH the higher the levels of Cu and Zn with the level of Cu approaching that of Zn (i.e. lower Zn/Cu ratios).

D. Lake Sediments

The distribution of Cu, Pb and Zn in surficial lake sediments reveals a wide range of values within and between individual lakes. With respect to the position of mineralization, metal values decrease down drainage from Camp Lake with Cu, Pb and Zn following the observed mobility order Zn>Cu>Pb (Tables 26 and 27). Anomalous Zn concentrations have higher contrast and larger anomalous dispersion trains than Cu or, in particular, Pb (cf. Cameron and Durham, 1974b). However, high Pb values are more likely to locate the source of an anomaly.

Relative to soils, sediments contain higher average concentrations of Pb and, in particular, Cu and Zn (Tables 9, 26 and 27) which cannot be explained by the relatively finer grain size of sediments versus soils. Because extensive flushing of Cu and Zn from soils overlying mineralized zones has been demonstrated, it can be concluded that large scale Cu and Zn anomalies in lake sediments are largely the result of their hydromorphic dispersion.

The relationship of high Cu and Zn values in lake waters with high levels of Cu and Zn in lake sediments is readily apparent (Tables 17 and 26, Fig. 101). Also, however, relatively low levels of Cu and Zn in lake waters appear to be able to give rise to significant lake sediment anomalies (e.g. Banana Lake) because sediments act as a sink or trap. Consequently, on a regional scale lake sediment anomalies offer a larger target than lake water anomalies (Fig. 10). Furthermore, the relatively low relief and low rate of sedimentation (1 to 3 inches/1000 years) aids formation of hydromorphic lake sediment anomalies by preventing dilution of anomalies with abundant organic and inorganic detritus. Conversely, lake waters are more dynamic with metal coming in (via soil drainage) and being removed simultaneously (via precipitation and outflow) resulting in a steady state condition.

Assuming Figure 127 is an adequate stratigraphic/geochemical model for near-center lake sediments at Bathurst Norsemines, it can generally be concluded that Cu, Pb and Zn values tend to increase with depth in sediment or remain constant; however, once the dense sand-silt-clay layer is penetrated, metal values decrease significantly. Conversely, Fe and Mn values increase - often dramatically - towards the sediment-water interface. Percent L.O.I. trends are mixed and generally display a narrow range of values within a lake.

In terms of stratigraphy, the sand-silt-clay layer is believed to represent till because it contains occasional pebbles and is too dense to be the result of normal lake sedimentation processes which give rise to the overlying gyttja and soft, silt-clay deposits. The latter often contains hair-like plant fibers (moss?) and occasionally a whitish, friable deposit (marl?) which probably formed soon after deglaciation and represents the first true lake sediment (cf. Karrow and Anderson, 1975). Deposited above this is a watery, organic-rich (10 to 35% L.O.I.) ooze commonly called gyttja or algal gyttja. Gyttja is composed of silt-clay particles bound by organic detritus, commonly algal remains and humic colloids (Timperley and Allan, 1974).

Fe and Mn nodules are commonly dispersed throughout lake sediments; however, they are usually concentrated at the sediment-water interface. Although the importance of Fe and Mn as scavengers of Cu, Zn and, to a lesser extent, Pb is well documented (Horsnail et al., 1969; Coker and Nichol, 1975; Chao and Theobald, 1976; Garrett and Hornbrook, 1976) Fe and, in particular, Mn display a negative correlation with Cu, Pb and Zn. In some cores Fe and Mn nodules become fewer, smaller and less well defined with depth (cf. Troup, 1969). This is consistent with conditions below the upper one to two inches of sediment changing from oxidizing to reducing conditions.

As a result of reduction below the sediment surface Mn and, to a lesser extent, Fe are mobilized and probably move towards the surface where they are reprecipitated, resulting in decreasing values with depth and, in some case, extraordinarily high values at the surface. Cu, Zn and, to some extent, Pb values display the opposite trend which suggests that they are either enhanced or at least are less mobile under reducing conditions.

Black bands which commonly occur in gyttja and silt-clay, also become more diffuse with depth. The absence of these bands in the near-surface oxidized zones combined with their diffuse (dissolution?) nature at greater depths within the sediment, suggests that these bands are formed along relatively long term, stable oxidation-reduction boundaries. Their exact nature is unknown but they commonly contain very high Cu and Zn concentrations, low Pb, Ag and Mn concentrations and moderate levels of Fe. Although these bands are assumed to be reducing, hydrogen sulphide was not detected by smell. Nevertheless, sulphides could be present and not detectable in this manner if the Cu/Zn supply is greater than the generation of sulphide ion (cf. Timperley and Allan, 1974).

Pb concentrations are too low in all water types to account for high Pb values in lake sediments. In addition, Pb trends within lake sediments often diverge from those of Cu and Zn and, most importantly, Pb values in near-shore sediments are very low while Cu and Zn values remain high. All of which suggests a different mode of origin for the formation of Pb anomalies in lake sediments. Because of the immobility of Pb, it is suggested that most of the Pb enters the lake basin sorbed on fine clay-sized particulate matter (i.e. clastic dispersion) rather than as a dissolved species (cf. Hoffman, 1976). Much of this particulate matter is dumped into lakes upon melting of the ice cover and through heavy runoff following thunderstorms and melting of remnant snowbanks. Ice scour and wave action would then prevent deposition of fine clay-sized sediments in high energy near-shore environments.

Increasing Cu and Zn values with respect to depth in sediment cannot be attributed to Fe, Mn or organic carbon enrichment. Although metal enhancement with depth may be related to 'aging' of organic matter (whereby important organic functional groups are known to increase with sediment depth cf. Manskaya and Drozdova, 1968 p. 243), this does not seem likely. On the other hand, metal-rich (Cu and Zn) groundwaters, emerging near the break-in-slope of the lake basin and flowing just above or up through the compact silt-clay layer, could be enhancing metal levels in the lower portions of the lake sediment (cf. Hoffman, 1976; Winter, 1974). This would explain the presence of the highest metal values often occurring near the bottom of lake sediments and at intermediate water depths, presumably where groundwaters emerge. Alternatively, the overall decrease in Cu, Pb and Zn values, as the sediment-water interface is approached, could be due to a concomitant decrease in the supply of these metals at the source (i.e. soils surrounding Camp Lake) as a result of post-glacial weathering.

III FINAL DISCUSSION AND SUMMARY

A. Element Dispersion

It is unclear whether there was more than one glacial episode in the Bathurst Norsemines Area. However, Blake (1963) and Craig (1960) discovered a shift in glacial direction from northwest to southwest. Measurements of glacial direction indicators by this author (Fig. 14) reveal a bimodal distribution consistent with those established by Blake (1963) (Fig. 13). Most of the glacial direction indicators and geochemical patterns are oriented west-northwest to northwest.

Nevertheless, there is a tendency for some geochemical patterns, particularly partial to total ratio patterns, to display a southwest orientation parallel to the less well developed set of glacial direction indicators.

Based on immobile element (Ag, Pb and Fe) patterns in soil, glacial dispersion of sulphide-rich till originated primarily from the three mineralized outcrops lying closest to B-C stream. Both boulder trains and more extensive micro-boulder or geochemical indicator trains are present. Ag, Pb and Fe display the best developed geochemical indicator trains. These occur in each soil layer as two subparallel, narrow, finger to fan-shaped patterns with values increasing down ice (to the west). The more northerly train is developed best and is easily related to the pair of mineralized outcrops west of B-C stream (e.g. Figs. 27 and 41). The general trend of the more northerly train is easily recognized in air photos as gossan (Plate 16).

An idealized Pb dispersion model for the northern geochemical indicator train at Camp Lake is shown in Figure 131. This model is based on the distribution of Pb in Layers 1 and 2 and the trend of Pb values with respect to depth (Figs. 40, 41 and 130). From this, it is suggested that dispersion was down ice in narrow, thin trains which gradually rose at low to very low ($<2^{\circ}$) angles from the bedrock-till interface. If these low angled trains are intercepted by surface soil sampling then the highest values may well occur at some distance down ice where the indicator train reaches the surface. At slightly deeper sampling depths the indicator train is intercepted closer to the source and the anomaly appears to approach the source relative to the pattern in the overlying soil (compare Figs. 40 and 41). At still greater depth, high Pb values are confined to an area immediately down ice and close to the bedrock source (cf. Figs. 128, 129 and 131).

It is presumed that Ag, Cu, Fe, Pb and Zn were all glacially dispersed in the same manner; however, the absence of Cu and Zn patterns similar to and superimposed on those of Ag, Fe and Pb is the result of extensive hydromorphic dispersion. Evidence for this is provided by high levels of Cu and Zn in seepage, pit, snow-melt and lake waters (Figs. 97, 98 and 101). Leaching of Zn has been most complete, resulting in the formation of negative anomalies in areas of high Ag, Fe and Pb values and low pH. However, high ($\geq$200 ppm) Zn values can be found in the western portion of the grid where pH's are more moderate. Nevertheless, relative to the amount of Zn in the ore (average grade 7.5%), there is a severe depletion in the soil. On the other hand, Pb appears to have been retained in the soil as a stable secondary mineral and is more readily extracted by reagents such as EDTA or dilute HCl than the remaining Zn. A mobility order of Zn>Cu>Fe>Ag>Pb is proposed.

Hydromorphic soil anomalies are largely confined to the

L-F-H horizon. These anomalies are restricted to elements of intermediate mobility (i.e. Cu and Fe). Zn, because of its high mobility, does not form hydromorphic soil anomalies. In mineral soil, the only area of significant hydromorphic soil anomalies occurs in the far western portion of the soil grid as a very striking north-south zone of very high Cu (Figs. 31 and 32).

Because of the high mobility of Cu and Zn, detailed soil geochemical patterns for these two elements are less satisfactory, relative to Pb, in locating possible sources of mineralization. This becomes most apparent at depth (Layer 2) where Cu and Zn display low contrast (Table 10) and geochemical patterns are more difficult to relate to mineralized sources than immobile element patterns (Figs. 30 to 32 and 42 to 44). Conversely, Pb soil geochemical patterns become better defined and possess higher contrast as sample depth increases (Figs. 40 to 42, Table 10). Nevertheless, broad areas of interest (with regards to sources of Cu and Zn mineralization) are readily outlined, with wide dispersion and excellent geochemical contrast, by dissolved Cu and Zn in seepage/pit, and snow-melt waters (Figs. 97 to 100). The highest Cu and Zn values in these waters surround mineralized outcrops and delineate those areas containing the lowest pH's and low, or in many cases, negative Cu and Zn soil geochemical anomalies (compare Figs. 99 and 100 with 30 to 32 and 42 to 44).

On a more regional scale, Cu and Zn form widespread lake water and center-lake sediment anomalies relatable to mineralization (Figs. 10 and 101 to 106). Individual lakes display homogeneous Cu and Zn values in water (Tables 16 and 17) but wide variation (up to 15x) in sediment (Table 26), largely as a function of texture and Eh (Figs. 107 to 127).

Lake water anomalies are generated from drainage of mineralized rock and/or metal-rich till. Consequently, lake water and, to a large extent, lake sediment anomalies are confined to lakes down drainage and/or down ice from mineralization. Because metal-rich till may have been glacially dispersed up drainage, some lake anomalies are higher than the mineralized sub-outcrop (e.g. Bat and Cathy Lakes, Figs. 12 and 101). A good correlation exists between high Cu and Zn values in lake waters and sediments (Tables 17 and 26, Fig. 101); however, because sediments act as a sink or trap and sedimentation rates are low (1 to 3 inches/1000 years), relatively low levels of Cu and Zn in lake water can give rise to significant lake sediment anomalies (e.g. Banana Lake, compare Figs. 101 and 103).

Although Pb was not detected in lake waters, it forms significant sediment anomalies which, unlike those for Cu and Zn, are restricted to lakes directly adjacent to mineralization and/or metal-rich till. This is because Pb, with its high immobility, enters lakes as a sorbed constituent on clay-silt particulate matter while Cu and Zn enter largely as dissolved species. As a result, the highest Pb values are found near the shore closest to mineralization but in water depths greater than 15 feet where wave action and ice scour do not prevent or disrupt accumulation of silt-clay sediments (Figs. 17 and 102 to 106). Conversely, the highest Cu and Zn values can be found anywhere within the lake but appear to occur predominantly at intermediate depths (Fig. 106).

Down drainage dispersion of Cu and Zn through a series of lakes is extensive in waters and sediments with anomalous concentrations extending farthest in lake sediments (Fig. 10). This is presumably a result of sediments acting as a trap and forming anomalies from low but anomalous levels of metals in lake water. Relative to Cu, Zn displays higher values and wider dispersion in both water and sediments as a result of its higher mobility as shown by Zn/Cu ratios (Fig. 101 and Tables 27 and 29). Contributions of snow-melt runoff, although potentially large, are restricted for the larger lakes because of long lasting ice cover which prevents mixing of snow-melt and lake waters.

The use of water as a sampling medium has often been criticized in North America because of: 1) bulk; 2) temporal variations; 3) metal concentrations near the detection limit of most analytical techniques and 4) pre-treatment such as acidifying, filtering, concentration etc. is often required. However, studies by this author and Cameron and Ballantyne (1975) and Cameron (1977b) show that in the Bathurst region lake waters are surprisingly free of these criticisms. Although lake waters were not pre-concentrated before analysis in this study, this procedure appears to be the only necessary step with regards to regional sample programs. Furthermore, the ease and rapidity with which samples can be collected argue well for the use of lake water as a regional or semi-regional exploration medium where deposits containing at least one mobile element are sought

Lake sediments also provide a good regional sample medium but wide variation within lake sediments makes sample site selection more critical, especially at low (1 sample/10 sq. miles) sample densities. If low sample densities are employed then one may wish to collect two samples per lake. This requires little additional effort, and anomalies, if any, can then be assigned priorities based on the number of anomalous samples and elements and their relative degree of geochemical contrast.

B. Application to Exploration

1. Regional

The application of geochemical exploration methods depend upon the state of geologic knowledge of the area and the type of mineralization sought. Assuming the geology is poorly understood then the area to be explored can be large and sample densities, will probably be low (1 sample per 5 to 10 mile^2). Locating a mineral deposit at this stage requires a certain amount of luck and normally the data are used to define smaller areas which appear favorable for mineralization. Fortunately, volcanogenic massive sulphides often occur in clusters or belts (Sangster, 1972), contain mobile elements (Cu and Zn) and, therefore, provide reasonably large geochemical targets. Consequently, lake sediments or waters provide the best regional sample media because they are widespread (Plate 5), quickly and easily sampled and can successfully represent the mineral potential of large areas. Stream sediments, although often chosen in other areas as a regional sample medium, are a poor choice at Bathurst Norsemines because streams are scarce and poorly defined.

The choice between lake waters and sediments is a difficult one. Lake waters have many advantages such as: 1) ease and speed of sampling; 2) highly homogeneous; 3) no sample preparation is required and 4) rapidity of analysis. Disadvantages are few, the most serious being the restriction of analysis to mobile elements and smaller anomalous halos relative to lake-center sediments (Fig.10). These disadvantages are considered minor relative to the advantages. However, if the sample density is greater than 1 sample per 3 mile^2, then lake sediments (particularly lake-center sediments) should be considered because of larger anomalous dispersion trains.

If lake sediments are chosen one must decide at what depth of water to collect samples. As shown in this study and others (Hoffman, 1976; Cameron, 1977b) there is a great difference in near-shore ($\leq$15 feet of water) versus lake-center sediments with regards to composition, texture and anomaly size and contrast. Although near-shore sediments are easier to collect, this is about their only advantage. In many cases, near-shore sediments display well developed patterned ground features and consequently, appear to be nothing more than sub-aqueous soils (Plate 16). Furthermore, in shallow areas, wave action and ice scour prevent deposition of silt-clay material by which Pb enters the lake. However, the deepest portions of the lake should also be avoided as they sometimes contain somewhat lower values, relative to intermediate depths (15 to 35 feet) which are the preferred sample sites (cf. Hoffman, 1976).

The distance of a lake from mineralization is less important than is the position of the lake with regard to hydromorphic and glacial dispersion of mineralization. Widespread geochemical dispersion occurs when the strike of the geology, glacial dispersion and post-glacial drainage do not coincide. This results in a high probability that lake water anomalies will be formed in several lakes adjacent to mineralization. If mineralization, glacial dispersion of sulphides and drainage are all restricted to one lake basin, then anomalous values within that lake may be quite high; however, such an anomaly can easily be missed because most regional programs sample only a small to moderate percentage of lakes in the reconnaissance area (Hoffman, 1976, pp. 325-326).

Because of the wide range in metal values within lake